# Appendix D

**Economic Analysis Appendix**

**Land Use Forecasts, Financial Returns and Economic Impacts**

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## Introduction

This Appendix presents both the methods and results of the economic analysis. It includes forecasts of land use, and the expected value of land, investment analyses, and how EIS alternatives will impact returns to the school trusts as well as larger impacts on the Montana economy. The basic idea behind the forecasts is that land allocation is a function of income and population. In other words, the demand for land depends upon the population and income in an area. Land allocation is defined in terms of land uses and the three key uses being analyzed are industrial, commercial and residential uses. The residential uses examined are parcels between 1 and 25 acres in size. In the most general terms the amount of land allocated to each of these uses is seen as being a function of the population and income in the particular geographical area. However, there is some minor variation in this general approach to modeling. The analysis of these uses is broken into two subcomponents. First a model is developed that predicts the variation in the land use in each of Montana's fifty-six counties. The second part of the exercise involves coupling the predictive models with forecasts of income and population for the six state land office areas to forecast the change in land uses for the period through the year 2025.

## Predicting and Forecasting Commercial and Industrial Land Uses and Values

The basic forecasts rely on combining the commercial and industrial land bases into one variable, the total commercial and industrial land in each county. After analyzing and forecasting this land category, changes in the ratio of commercial to industrial lands for each land office are discussed. Commercial and industrial uses are categories that are commonly used in land use planning and taxation in Montana. At times, it is hard to actually distinguish these uses from residential uses. For example, multifamily dwellings are taxed as commercial land uses in Montana.

The estimates of commercial and industrial land relied upon data provided by the Montana Department of Revenue property tax database for the year 2002. This data was summarized into acreage totals for each county. Model 1 below predicts the number of commercial/industrial acres in each county as a function of county income, (the product of percapita personal income times county population), a "dummy (0,1) variable" (SMALLCTY) which has the value of 1 for counties with populations less than 2500 people and two interactive variables (CLOICINC and SWLICINC). One of these variables takes the value of county income for counties in the Central Land Office (CLOINC) and otherwise has the value of zero. Likewise the SWLICINC variable is the county income for each county in the Southwest Land Office and is zero for the other counties. The results of the model are summarized in Table 1.

Table 1
Predicting the Combined Commercial and Industrial Land Base
In Montana Counties

Dependent variable is BUSINAC Mean = 2726.75350, S.D. = 3374.6318
Model size: Observations = 56, Parameters = 5, Deg.Fr. = 51
Residuals: Sum of squares= 0.174058E+09 Std.Dev. = 1847.40470
Fit: R-squared = 0.72211, Adjusted R-squared = 0.70031
Model test: F[ 4, 51] = 33.13, Prob value = 0.00000
Results Corrected for heteroskedasticity
Breusch - Pagan chi-squared = 7.4591, with 4 degrees of freedom

| Variable | Coefficient | Standard Error | t-ratio | p-value | Mean of X |
|---|---|---|---|---|---|
| Constant | 1437.6 | 324.43 | 4.431 | 0.00005 | |
| CLOICINC | -0.98555E-06 | 0.50651E-06 | -1.946 | 0.05720 | 0.1197E+09 |
| SWLICINC | 0.10898E-05 | 0.32764E-06 | 3.326 | 0.00164 | 0.7651E+08 |
| SMALLCTY | -1428.1 | 322.43 | -4.429 | 0.00005 | 0.1250 |
| CTYINCOM | 0.40615E-05 | 0.19295E-06 | 21.049 | 0.00000 | 0.3699E+09 |

Based upon the calculated F statistic, the overall equation is significant. The adjusted R-square indicates that the model explains about 70 % of the variation in the number of acres of commercial and industrial land in each county. The industrial/commercial land base in each county is extremely variable. The range in industrial/commercial acres is 28 acres to 15,800 acres and the mean is 2726.7 acres per county. Each of the variables included in the model are statistically significant based upon two-tailed t-tests at an alpha level of .1. Since the forecasts of future land use are based on forecasts of population and percapita income in each county, the above equation is most useful in this regard. The forecasts developed by Polsin are for population and income at the land office level. Thus each county's income and population can be grown at the rate of the land office in which it is contained so that future levels of land use in each respective land office can be estimated.

The interactive variables indicate that, other things equal, there is less commercial/industrial land in central land office counties than other counties and more commercial/industrial land in southwestern land office counties than other counties. Again, however, counties within either Southwestern or Central Land office with high county personal income have greater commercial/industrial lands than those with lower county personal income.

The equation that predicts the value of combined commercial and industrial land in each county is found in table 2. The land value is again the assessed market land value for commercial and industrial lands and comes from the Department of Revenue 2003 property tax assessment.

Table 2
Predicting the Value of Commercial/Industrial Land Value per Acre
in Montana Counties

Dependent variable is COMICVAC Mean = 6014.75589, S.D. = 7612.2731
Model size: Observations = 56, Parameters = 5, Deg.Fr. = 51
Residuals: Sum of squares= 0.324219E+09 Std.Dev. = 2521.35714
Fit: R-squared = 0.89827, Adjusted R-squared = 0.89029
Model test: F[ 4, 51] = 112.58, Prob value = 0.00000
Results Corrected for heteroskedasticity
Breusch - Pagan chi-squared = 9.2440, with 4 degrees of freedom

| Variable | Coefficient | Standard Error | t-ratio | p-value | Mean of X |
|---|---|---|---|---|---|
| PCAPY01 | 0.95906E-01 | 0.18106E-01 | 5.297 | 0.00000 | 0.2137E+05 |
| CLOICINC | 0.71971E-05 | 0.13642E-05 | 5.276 | 0.00000 | 0.1197E+09 |
| NWLICINC | 0.91733E-05 | 0.44337E-06 | 20.690 | 0.00000 | 0.4938E+08 |
| SWLICINC | 0.24281E-05 | 0.41572E-06 | 5.841 | 0.00000 | 0.7651E+08 |
| POP2002 | 0.15471 | 0.59898E-02 | 25.829 | 0.00000 | 0.1624E+05 |

The model in Table two is again significant based on the calculated F-statistic. While there is high variation in the value per acre of combined commercial and industrial lands in each county (a range of $178/acre to $30154/acre) the model summarized in Table 2 explains 89 percent of this total variation. The explanatory variables again are significant at an alpha level of .1. They are essentially based on both income and population. PCAPY01 is the percapita income in each county in the year 2001.

POOP2002 is the county population in the year 2002. CLOICINC is the county income for each county in the Central Land Office. It has a value of zero for counties not in this land office. NWLICINC and SWLICINC respectively are calculated in the same way for counties in the Northwest and Southwest land offices. (County income is the product of population and percapita income). The coefficients for these variables indicate that other things equal, counties in these land offices have higher land values for commercial and industrial lands than for counties in other land offices. Forecasts at the land office level for future industrial/commercial land prices are based on forecasts of population and income developed by Polsin (2003).

The forecasts of industrial/commercial acreages and commercial/industrial land values were made in a spreadsheet. These are the steps involved in developing the forecasts. First, the Polsin forecasts of population, percapita personal income and county personal income were converted to compound rates of change for the forecasting period. Next these compound rates of change were used to forecast, population, percapita income and county income in each county. Next the acreage for each county was forecast into the future. These forecasts were then summed into a land office total. Compound rates of change were then calculated for each land office and applied to the actual base acreage and land office weighted land prices. These steps were done since the population itself was a cross section of counties and the forecasts and analysis were made at the land office level. Table 3 below contains the combined Commercial/Industrial land base forecasts for each land office.

Table 3
Forecasts for Total Commercial/Industrial Acres by DNRC Land Office

| | | Mid-Range | Forecast | Rural | Residence | |
|---|---|---|---|---|---|---|
| | | | 1 to 26 Acres | | | |
| Land Off | Actual2003 | 2005 | 2010 | 2015 | 2020 | 2025 |
| Clo | 133970.6 | 135430 | 143754.4 | 151188.6 | 158820.4 | 166809.5 |
| elo | 11404.9 | 11346.62 | 11278.67 | 11275.88 | 11287.67 | 11360.55 |
| nelo | 19951.75 | 19879.04 | 19953.52 | 20083.09 | 20283.31 | 20519.63 |
| nwlo | 131900.8 | 133318.5 | 140876.2 | 147589.8 | 154287.7 | 161536.6 |
| slo | 52553.42 | 53182.99 | 56357.77 | 59280.7 | 62235.75 | 65405.95 |
| swlo | 104786.2 | 106289.8 | 115242.2 | 122679.6 | 130121.7 | 137646.3 |
| | 454567.7 | 459446.9 | 487462.7 | 512097.7 | 537036.6 | 563278.6 |

It is clear from the forecasts that there will be a substantial increase in the land associated with commercial and industrial land uses. There is considerably more commercial land use than industrial. In fact for every acre taxed as “industrial” in 2002, there was about 5.7 acres taxed as commercial. Keeping in mind that multifamily apartments and mixed commercial offices and residential buildings are included in the commercial land base, these uses are expected to grow in the future. It should also be apparent that from the origins of commercial and industrial land uses in Montana, commercial uses have grown relative to industrial uses. While the commercial and industrial lands are lumped together for purposes of forecasting, it may be useful to recognize that the commercial land uses are expected to grow relative to the industrial uses throughout the planning horizon.

The forecasts for Commercial/Industrial Land Value are presented in Table 4 below.

Table 4
Commercial and Industrial Land Value
By DNRC Land Office
Expressed in Constant 2003 Dollars Per Acre

| Land Off | $/ac 2003 | $/ac2010 | $/ac2015 | $/ac2020 | $/ac2025 |
|---|---|---|---|---|---|
| clo | 11674.81 | 13806.92 | 15332.96 | 17027.68 | 18909.71 |
| elo | 3911.467 | 4148.421 | 4303.753 | 4464.9 | 4632.082 |
| nelo | 2469.745 | 2583.756 | 2657.67 | 2733.698 | 2811.902 |
| nwlo | 19160.28 | 23613.86 | 26908.86 | 30663.63 | 34942.33 |
| slo | 13883.9 | 15563.6 | 16715.1 | 17951.81 | 19280.01 |
| swlo | 10401.86 | 12095.28 | 13290.97 | 14604.85 | 16048.62 |

The values come from the Department of Revenue assessed market values of commercial and industrial lands in each county. The land office averages were first developed on a county basis using steps similar to those discussed for the spreadsheet calculations of acre forecasts previously in this section. These prices were then weighted by the respective forecast acres in each county to derive averages for each land office. While these values are “bare land” values. They do represent the values of developed commercial and industrial sites. In order to get “raw land” commercial and industrial values used in the financial analyses, the above forecast prices will be multiplied by a factor of 1/3.

## Forecasting Land Use and the Value of Rural Residential Lands

Residential land uses in Montana occupy a vast range of landscapes and ownership sizes. Each farm or ranch typically has one or more home sites. At the other end of the spectrum are city and town lots with single-family residences. After considerable discussion with DNRC staff and based on their understanding of the spatial configuration of state trust lands, it was decided to focus the analysis on what is typically referred to as "rural residences". From the standpoint of the Department of Revenue CAMA database, rural residences were defined for this analysis as private parcels with a single-family residence that were greater than one acre but less than or equal to 25 acres in size. The forecasts of growth in this particular land use and expected increases in value were limited to this segment of the land base because of the nature of the distribution of trust land parcels and their potential to be developed for this kind of land use.

Table 5 includes the statistical model that was developed to forecast the future land base devoted to rural residences. The calculate F-statistic reported in Table 5

Table 5
Predicting the Rural Residential Land Base
Properties 1 to 25 acres in size

Dependent variable is RRAC125 Mean = 7559.71347, S.D. = 11794.3848
Model size: Observations = 56, Parameters = 6, Deg.Fr. = 50
Residuals: Sum of squares= 0.212120E+10 Std.Dev. = 6513.36614
Fit: R-squared = 0.72275, Adjusted R-squared = 0.69503
Model test: F[ 5, 50] = 26.07, Prob value = 0.00000
Results Corrected for heteroskedasticity
Breusch - Pagan chi-squared = 69.2452, with 5 degrees of freedom

| Variable | Coefficient | Standard Error | t-ratio | P-value | Mean of X |
|---|---|---|---|---|---|
| CLOPOP | 0.37625 | 0.68420E-01 | 5.499 | 0.00000 | 5059. |
| ELOPOP | 0.24959 | 0.33362E-01 | 7.481 | 0.00000 | 834.2 |
| NELOPOP | 0.22350 | 0.45057E-01 | 4.960 | 0.00001 | 1477. |
| NWLOPOP | 0.66773 | 0.54733E-01 | 12.200 | 0.00000 | 2378. |
| SLOPOP | 0.19236 | 0.10322E-01 | 18.636 | 0.00000 | 3061. |
| SWLOPOP | 0.46447 | 0.13186 | 3.522 | 0.00092 | 3431. |

indicates the equation is significant and the R-squared adjusted for degrees of freedom indicates that the seven independent variables explain about 73% of the variation in rural residential land base in the 56 counties. Acreage for rural residences from 1 through 25 acres is highly variable. The average number of acres per county in the 2003 Department of Revenue appraisal was 7,559.71/county among the 56 counties. One county had only 102.64 acres of rural residences while the county with the highest number of rural residences had 51,493.9 acres in rural residences.

The independent variables that explain the variation among the counties essentially combine county population with dummy variables for the various land offices. For example, CLOPOP is the result of multiplying the 0,1 dummy variable for the Central Land office counties times the population in the counties. The ELO and NELO are simply 0,1 variables for counties in the Eastern and Northeastern Land Offices respectively. Each independent variable is significant at an alpha test level of 0.1. Forecasts of population are used to forecast future acreages.[1]

Table 6 contains consists of a summary of the model that predicts land value per acre in rural residences.

Table 6

Predicting the Value of Rural Residential Land In Montana Counties
Value per Acre Residences (> 1 acre and <= 25 acres)

Dependent variable is RRESVPAC Mean = 2734.61824, S.D. = 3070.9411
Model size: Observations = 56, Parameters = 7, Deg.Fr. = 49
Residuals: Sum of squares= 0.188014E+09 Std.Dev. = 1958.83324
Fit: R-squared = 0.63752, Adjusted R-squared = 0.59313
Model test: F[ 7, 48] = 14.36, Prob value = 0.00000
Results Corrected for heteroskedasticity
Breusch - Pagan chi-squared = 57.5047, with 6 degrees of freedom

| Variable | Coefficient | Standard Error | t-ratio | P-value | Mean of X |
|---|---|---|---|---|---|
| CLO | 2319.8 | 525.70 | 4.413 | 0.00006 | -.25 |
| ELO | 497.93 | 122.89 | 4.052 | 0.00018 | 0.1607 |
| NELO | 489.07 | 128.23 | 3.814 | 0.0038 | 0.2679 |

[1] Income was not a significant predictor of residential uses and was dropped from the equations

| | | | | | |
|---|---|---|---|---|---|
| NWLO | 6076.1 | 2312.1 | 2.628 | .01144 | 0.7143E-01 |
| SWLO | 1572.3 | 751.68 | 2.092 | .04167 | 0.125 |
| SLO | 4047.9 | 792.76 | 5.106 | 0.00001 | 0.125 |
| POP2002 | 0.49697E-01 | 0.15316E-01 | 3.245 | 0.00212 | 0.1624E+05 |

Land value per acre again came from the 2003 Department of Revenue property tax appraisals and the value per county is highly variable with a range of $161.10/acre to $14,769.61/acre. The model is significant (based on a calculated F of 24.36) and the independent variables explain 59.3% of the total variation. The population variable (POP2002) shifts land value for each county and the dummy variables for counties in each land office shifts the value of the counties in each respective land office. All of the independent variables are significant at the alpha level of .10. Forecasts of land rural residential land value rely on forecasts of population and utilize the coefficients for population and land office found in the above equation.

Table 7 contains the forecasts of future acreages in the rural residential land uses.

Table 7
Future Rural Residential Land Use
Parcels 1 through 25 acres in Size
By DNRC Land Office

| | Rural | Residential | 1 to 26 Ac | | |
|---|---|---|---|---|---|
| | | forecast | total | rural1-25 | midrange |
| landoff | rrac03 | rrac10 | rrac15 | rrac20 | rrac25 |
| clo | 133015.6 | 136667.8 | 143724.8 | 151150.9 | 158907.8 |
| elo | 12359.92 | 12189.87 | 12230.36 | 12327.93 | 12392.38 |
| nelo | 19951.75 | 19771.67 | 19833.14 | 19922.2 | 20049.72 |
| nwlo | 100677.2 | 115045.6 | 124401 | 133974.9 | 143939.5 |
| slo | 52553.42 | 56912.93 | 59842.22 | 62893.74 | 66100.08 |
| swlo | 104786.2 | 116219.4 | 124110 | 132271.9 | 140731.2 |
| total | 423344 | 456807.2 | 484141.6 | 512541.5 | 542120.6 |

It is clear from Table 7 that rural residential land uses involve a far greater land base than combined rural/industrial land uses reported in Table 3. It is also apparent that the land offices which have the highest rates of population growth are forecast to have the highest rate of rural residential land use growth.

Table 8 below contains the forecasts of land prices for rural residential lands in the six state land offices. These land values result from applying the population forecasts to the land price model reported in Table 6 and then weighting the expected future prices by the expected acreages in the various counties to come up with weighed average expected future prices by land offices.

Table 8
Expected Future Prices of
Rural Residential Lands in DNRC Land Offices (2003 prices)

| | Rural | | Future Prices Residences 1 to 26 Ac | $/Acre | |
|---|---|---|---|---|---|
| | 2003 | 2010 | 2015 | 2020 | 2025 |
| CLO | 5006.88 | 5223.22 | 5373.237 | 5529.935 | 5693.934 |
| ELO | 914.3079 | 905.7535 | 903.7046 | 902.5932 | 902.2351 |
| NELO | 937.5223 | 933.4748 | 934.8563 | 936.8581 | 939.7245 |
| NWLO | 8742.646 | 9123.208 | 9370.997 | 9624.572 | 9888.496 |
| SLO | 6700.29 | 7125.676 | 7411.507 | 7709.263 | 8022.128 |
| SWLO | 7236.395 | 7584.29 | 7824.393 | 8072.745 | 8330.15 |

The land offices that have the highest rates of increase in population growth are forecast to experience the highest rates of growth in residential land prices. The Eastern Land Office is forecast to experience a slight drop in the real price of rural residential land and the Northeast Land Office is forecast to experience a very modest price increase. The Southern Land Office, Southwest Land Office and Northwest Land Offices are expected to experience the largest rates of increase in rural residential land prices over the planning horizon. It is also clear that the typical industrial/commercial parcel (Table 4) is worth considerably more than the typical rural residential parcel (Table 8).

## Growth in Land Use

Tables 3 and 7 above show the total expected future land use for combined commercial/industrial and rural residential land uses for the midrange forecast. The following table (Table 9) shows the growth in land uses over the planning horizon. The mid-range growth forecasts are “periodic”. That means that each entry in the table show how much the land base is expected to change in the particular growth period. Only the mid-range growth forecasts are shown in the table. The analysis includes both a high bound and low bound forecasts which are based on these tables but include a plus/minus 25% range around the mid-range forecasts.

Table 9
Mid-Range, Periodic Growth in Rural Residential
And Commercial/Industrial Land Uses

| Land off | Periodic 2003-2010 | All owner Growth 2011-2015 | Rural Resid 2016-2020 | 1 thru 25 Acres Midrange 2021-2025 | Total |
|---|---|---|---|---|---|
| Clo | 3652.26 | 7056.973 | 7426.109 | 7756.869 | 25892.21 |
| Elo | -170.045 | 40.49225 | 97.56398 | 64.45461 | 32.466 |
| Nelo | -180.074 | 61.46374 | 89.0597 | 127.5268 | 97.97592 |
| Nwlo | 14368.39 | 9355.426 | 9573.896 | 9964.606 | 43262.32 |
| Slo | 4359.506 | 2929.295 | 3051.514 | 3206.345 | 13546.66 |
| Swlo | 11433.17 | 7890.694 | 8161.822 | 8459.31 | 35945 |
| Total | 33463.21 | 27334.34 | 28399.96 | 29579.11 | 118776.6 |

| Land Off | 2002-2010 | Periodic Commercial/ 2011-2015 | All owners Growth Industrial 2016-2020 | (Mid-range) 2021-2025 | Total |
|---|---|---|---|---|---|
| CLO | 5044.5734 | 3172.3282 | 3579.714602 | 3969.178073 | 15765.79429 |
| ELO | 425.72768 | 175.71355 | 206.3318014 | 225.7500579 | 1033.523083 |
| ELO | 425.72768 | 175.71355 | 206.3318014 | 225.7500579 | 1033.523083 |
| NELO | 1036.3267 | 820.19902 | 890.82413 | 981.4201587 | 3728.770046 |
| NWLO | 3387.3173 | 2236.9846 | 2471.57472 | 2734.005999 | 10829.88267 |
| SLO | 3474.618 | 2299.9123 | 2579.665189 | 2877.551653 | 11231.74714 |
| SWLO | 4209.3636 | 2786.2536 | 3125.163289 | 3486.041067 | 13606.82153 |
| TOTAL | 17577.927 | 11491.391 | 12853.27373 | 14273.94701 | 56196.53875 |

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## Defining the DNRC Alternatives in terms of Land Base and Land Use Change.

EIS alternatives are based on the current role of DNRC ownership in the current land uses. At the present time, the DNRC has the following proportions of developable land in each of the land offices.

| | |
|---|---|
| Central Land Office | 8% |
| Eastern Land Office | 8% |
| Northeastern Land Office | 9% |
| Northwestern Land Office | 10% |
| Southern Land Office | 4% |
| Southwestern Land Office | 7% |

These percentages are fundamental to the definition of three of the EIS alternatives.

Alternative B is to develop trust land in proportion to the relative share of the ownership of developable land in each land office. Thus for example, DNRC would take 8% of the growth in residential/industrial and rural residential growth in the Central Land Office. Alternative C which is a more aggressive growth policy is one where the DNRC would double its proportionate share of growth and alternative C is one where the state would grow at half of its proportionate share. Thus, again using the Central Land Office as an example, the Central Land office would take 4% of the growth under Alternative A and 12% of the growth under alternative C. These are summarized in Table 12.

Table 12
EIS Alternatives and DNRC Growth Shares

| Land Office | Alt A ½ Proportionate Share (Modest) | Alt B Proportionate Share | Alt C Double Proportionate Share (Aggressive) |
|---|---|---|---|
| Central Land Office | 4% | 8% | 16% |
| Eastern Land Office | 4% | 8% | 16% |
| Northeastern Land Office | 4.5% | 9% | 18% |
| Northwestern Land Office | 5% | 10% | 20% |
| Southern Land Office | 2% | 4% | 8% |
| Southwestern Land Office | 3.5% | 7% | 14% |

## Rates of Return on EIS Alternatives

The rates of return were calculated in a manner consistent with other rates of return calculations used by the Montana DNRC. They are rates of return on equity. In essence these calculations examine net income as a percentage of the capital value of assets rather than simply as the interest rate that equates the present value of a stream of benefits with a stream of costs. The formal calculation of the return on asset value is the net annual income divided by the asset value. This is a very tedious calculation for a number of reasons. First, when conservation easements are sold, the proceeds are deposited into the school trust fund. This in turn is invested and yields annual earnings (95% of the earnings then are used to aid in school or other trust beneficiaries). However, only 5% of lease income is deposited in the trust fund, the rest is made available to provide support for the schools or other trust beneficiaries. Of course, interest earnings reflect a premium for inflation.

After discussions with Paul Engelman, DNRC economist, the calculations for rates of return were done as follows. Equity is estimated by calculating the market value of the land developed over the planning horizon. Since this value reflects price changes as well as changes in yearly quantities, it was calculated by averaging the values in the first and second half of the planning horizon. Gross income is estimated by calculating the total gross income from the mix of leases and land sales over the planning period and then converting it to an average annual amount. The costs needed to convert gross annual income to net income are more problematic from the standpoint of rate of return calculations. This is the structure of annual costs developed by DNRC staff for the three alternatives.

Table 13
Cost Data

| EIS Alternative | Current Budget | Additional Budget per Alternative |
|---|---|---|
| Alternative A | $1,089,558 | $0. |
| Alternative B.1 | $1,089,558 | $193,960. |
| Alternative B.2 | $1,089,558 | $693,960. |
| Alternative C.1 | $1,089,558 | $255,160. |
| Alternative C.2 | $1,089,558 | $1,255,160. |

Alternative A presents a unique problem in calculating rates of return. The income generated in Alternative A is positive while the extra costs of producing the income are 0. This arises because the DNRC will use its existing budget and staff to continue to develop land leases and sales as well as to service existing leases and operations. As a result, cost apportionment techniques are used that allocate the current budget between new income producing activities associated with EIS Alternative A and existing income producing activities. After calculating rates of return on equity based on this initial apportionment formula, an analysis is employed to see the extent that the ranking of alternatives is dependent on the apportionment method.

The initial approach to cost apportionment is use the estimated average income generated under Alternative A as a percentage of current income from real estate special use operations. The figure is 37%. Thus 37% of the current budget is used as a starting point for calculating the cost of Alternative A.  This figure ($403,136) was added to the Additional budget items in the third column above to estimate a total cost of each EIS alternative.

In calculating rates of return, you should notice that there are alternatives noted as B.1 and B.2 as well as C.1 and C.2. The difference lies in the role the DNRC could play in actual development.  These differences are noted as "with" or "without" up-front development costs.  Currently the state has no money to do the permitting, and infrastructure (streets, utilities) development to create a developed lot.  They sell or lease "raw" land.  The alternatives with "up-front" development costs both have higher annual budgets and uniquely different income streams.  The land leased or sold that is developed has a higher value, however there is a lagged period of time before the higher revenues are earned which reflect the value of developed versus raw land.   A four-year lag was used in the calculation of these income streams with up-front development.

These other details are important to calculating the rates of return on equity.

- Rural Residential lease rates are 5% of full market value
- All land sales at full market value
- Raw land values are 1/3 of the value of commercial and residential lands which are developed
- Commercial/industrial lease rates range from 5% to 10%.  A 7.5% figure was used in the analysis
- Conservation easement lease rates are 2.5% of the raw rural residential land value
- Conservation easement sales were 50% of the raw rural residential land value
- The mix of sales and leases for rural residential and commercial/industrial are as follows: 90% sales, 10% lease for rural residential and 90% lease, 10% sales for commercial/industrial

The planning team developed the following rates of conservation easement *sales* per year for each land office.  They do not expect these to be a smooth rate of sales.

Table 13
Easement Sales

| Alternative | CLO | ELO | NELO | NWLO | SLO | SWLO |
|---|---|---|---|---|---|---|
| A | 173 | 28 | 209 | 34 | 6 | 16 |
| B | 313 | 57 | 308 | 59 | 20 | 35 |
| C | 422 | 66 | 410 | 77 | 32 | 53 |

In addition, they anticipate a new program of conservation easement *leases* under alternatives B and C as follows. Again these figures are expressed as annual equivalents but will likely be leased in more larger irregular amounts.

Table 14
Easement Leases

| Alternative | CLO | ELO | NELO | NWLO | SLO | SWLO |
|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 0 | 0 | 0 |
| B | 47 | 0 | 0 | 98 | 12 | 57 |
| C | 94 | 0 | 0 | 197 | 25 | 94 |

The calculations yield the following estimated average annual rates of return on equity.

Table 16
Rate of Return on Equity For EIS Alternatives

| EIS Alternative | Rate of Return on Equity* | Rate of Return on Equity |
|---|---|---|
| Current Situation | 2.13% | 2.13% |
| Alternative A | 2.76% | 2.76% |
| Alternative B.1 | 4.66% | 4.73% |
| Alternative B.2 | 5.05% | 5.13% |
| Alternative B-1 | 4.38% | 4.46% |
| Alternative C.1 | 5.48% | 5.55% |
| Alternative C.2 | 6.27% | 6.35% |
| Alternative C-1 | 5.21% | 5.14% |

*The differences in the rates of return result form the consideration of extra conservation leases as described in the earlier in table 14

Table 17
Rate of Return on Equity For EIS Alternatives
With 50/50 Cost Share Between New Activities in Alternative A
and existing Activities

| EIS Alternative | Rate of Return on Equity* | Rate of Return on Equity |
|---|---|---|
| Current Situation | 2.13% | 2.13% |
| Alternative A | 3.87% | 3.87% |
| Alternative B.1 | 4.10% | 4.07% |
| Alternative B.2 | 4.50% | 4.57% |
| Alternative B-1 | | |
| Alternative C.1 | 5.20% | 5.28% |
| Alternative C.2 | 6.00% | 6.07% |

*The differences in the rates of return result form the consideration of extra conservation leases as described in the earlier in table 1

You will notice that the rates of return for each EIS alternative shown in Table 16 are greater than the rate shown for existing activities. From a standpoint of investment theory, Alternative C.2 is the preferred alternative. It has the highest rate of return and each alternative is preferred to the existing situation.

Table 17 shows the rates of return where the assumption regarding the allocation of the current budget between existing activities and those envisioned under alternative A is relaxed. The costs used to calculate the rates of return in Table 17 include 50% of the current budget shown in table 15. These costs ($544,779) are added to the amounts in the additional costs item (column 3 in Table 15) in calculating the alternative rates of return on equity. Of course when costs increase, net income decreases as do rates of return on equity. However, the ranking of the EIS alternatives is not affected The rates of return for alternatives B.1, B.2, B.3, and B.4 are all considerably greater than the rate of return for Alternative A. In addition, all are considerably greater than is the current situation.

## Returns on the Trust Fund

As was discussed earlier, some of the income from these programs goes into the School Trust fund and some goes directly toward the support of schools and other state institutions supported in part with trust lands. Table 16 below summarizes these transactions estimated for the trust fund.

Table 18
School Trust Account
Estimated Deposits and Earnings for the EIS Alternatives*

| | Average Annual Deposits | Average Annual Earnings |
|---|---|---|
| EIS Alternative A | $811,143 | $664,342 |
| EIS Alternative B | $1,406,246 | $1,126,982 |
| EIS Alternative C | $2,580,376 | $2,153,621 |

* Deposits become a permanent part of the trust fund balance. A 5% interest rate was used to calculate the interest. Deposits and earnings were averaged over the planning horizon.

## Economic Impacts-Local Jobs

The economic impacts envisioned in this report may be a bit different from those commonly estimated and reported in an EIS. The view here is rather simple. The growth is going to occur. The sustentative issue is what role will state lands have in the growth and development of lands in Montana? The jobs, taxes and income reported in this and subsequent sections really represent the share of the total jobs, income and taxes that will be paid as a result of development in the state.

Table 19
Local First Year Jobs Associated with DNRC Development Share

| Total | DNRC<br>ALT B | Share | First Year | Jobs |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 362.4359 | 262.2084 | 292.4809 | 321.2814 |
| ELO | 30.43134 | 12.56014 | 14.74876 | 16.13679 |
| NELO | 83.33711 | 65.95701 | 71.63639 | 78.92175 |
| NWLO | 542.1261 | 390.8496 | 422.1247 | 458.9749 |
| SLO | 141.7889 | 97.00023 | 107.9502 | 119.6995 |
| SWLO | 309.9033 | 220.6768 | 243.211 | 267.2608 |

| First Year | Impacts | Local Jobs | ALT A | |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 181.218 | 131.1042 | 146.2404 | 160.6407 |
| ELO | 15.21567 | 6.28007 | 7.374378 | 8.068394 |
| NELO | 41.66855 | 32.97851 | 35.8182 | 39.46088 |
| NWLO | 271.0631 | 195.4248 | 211.0623 | 229.4874 |
| SLO | 70.89446 | 48.50012 | 53.97512 | 59.84977 |
| SWLO | 154.9516 | 110.3384 | 121.6055 | 133.6304 |

| First Year | Impacts | Local Jobs | Alt C | |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 716.6148 | 502.0808 | 561.4573 | 618.0114 |
| ELO | 60.86268 | 25.12028 | 29.49751 | 32.27358 |
| NELO | 166.6742 | 131.914 | 143.2728 | 157.8435 |
| NWLO | 1018.895 | 722.1229 | 783.2817 | 854.494 |
| SLO | 277.9327 | 188.69 | 210.3685 | 233.5864 |
| SWLO | 594.2625 | 416.6725 | 460.8928 | 508.0618 |

These employment impacts (along with the tax and income impacts reported in the next sections) are based on a study by Adair and Heath (2002), which estimated construction impacts for both single family and multiple family housing in a number of Montana housing markets. The multiple housing impacts were modified to address the impacts of commercial/residential development.  Much of the development on lands listed and taxed as "commercial" by the Montana Department of Revenue are apartment houses.

## Income Impacts of the Alternatives

Reported next are the impacts or share of personal income associated with development and construction.  Again these represent only the share of total personal income per EIS alternative so that if ,for example, the state share is 10% in a region, the figures in the table represent 10% of the total income.

Table 20
Share of Personal Income Associated with DNRC Development Share

| Combine Local Income | | | | |
|---|---|---|---|---|
| First Year | Local | Income | Alt B | |
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 11312739 | 8184331 | 9129227 | 11560823 |
| ELO | 1103781 | 455571.2 | 534954.9 | 585300.4 |
| NELO | 3022736 | 2392339 | 2598337 | 2862586 |
| NWLO | 18505157 | 13341423 | 14408978 | 19998887 |
| SLO | 5730102 | 3920061 | 4362583 | 5307220 |
| SWLO | 11712634 | 8340367 | 9192034 | 12101052 |

| Combined | Local | Income | Alt A | |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 5656369 | 4092166 | 4564614 | 5780411 |
| ELO | 551890.4 | 227785.6 | 267477.4 | 292650.2 |
| NELO | 1511368 | 1196170 | 1299168 | 1431293 |
| NWLO | 9252579 | 6670712 | 7204489 | 9999443 |
| SLO | 2865051 | 1960031 | 2181291 | 2653610 |
| SWLO | 5856317 | 4170183 | 4596017 | 6050526 |

| First Year | Local | Income | Alt C | |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 22367751 | 15671486 | 17524810 | 21589002 |
| ELO | 2207562 | 911142.3 | 1069910 | 1170601 |
| NELO | 6045472 | 4784678 | 5196674 | 5725171 |
| NWLO | 34779398 | 24649241 | 26736861 | 35665725 |
| SLO | 11232067 | 7625513 | 8501602 | 10144626 |
| SWLO | 22459844 | 15747920 | 17419203 | 22202036 |

The local income is the direct result of construction and construction activities.  It is the "first-year income" which means that it is a conservative estimate of the total income that is associated with development. The above figures are yearly amounts. These are sustainable as long as the levels of construction are sustainable.

## Tax Impacts and EIS Alternatives

The final impact included in the economic analysis is the impact of development on tax receipts. Of course, state lands are not taxed although improvements on leased state lands are. Thus, development of state lands can change the tax base in a variety of ways. The improvements on leased lands enter the tax base and the lands and improvements on lands that are sold to the private (taxed) sector enter the tax base. That complexity is a bit beyond this analysis so that these tax impacts are perhaps a bit lower than will occur since these are essentially based on the taxes (first year) that arise from the development of lands already in the tax base (perhaps in a lower valued and taxed use).

Table 21
Tax Impacts
DNRC Development Share

| First Year | Impacts | Local Taxes | | |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 799531.9 | 502793.3 | 567361.4 | 629088.8 |
| ELO | 51578.55 | 21288.37 | 24997.89 | 27350.49 |
| NELO | 141249.3 | 111791.5 | 121417.6 | 133765.7 |
| NWLO | 875662.2 | 578287.4 | 638931.8 | 706773.4 |
| SLO | 268069.5 | 177440 | 199023.2 | 222005.3 |
| SWLO | 490499.3 | 324670.3 | 364162.1 | 406213.6 |

| First Year | Impacts | Local Taxes | | Alt A |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 399766 | 251396.6 | 283680.7 | 314544.4 |
| ELO | 25789.27 | 10644.19 | 12498.95 | 13675.24 |
| NELO | 70624.67 | 55895.77 | 60708.81 | 66882.84 |
| NWLO | 437831.1 | 289143.7 | 319465.9 | 353386.7 |
| SLO | 134034.7 | 88720 | 99511.58 | 111002.7 |
| SWLO | 245249.7 | 162335.2 | 182081 | 203106.8 |

| First Year | Impacts | Local Taxes | | Alt C |
|---|---|---|---|---|
| | 2002-2010 | 2011-2015 | 2016-2020 | 2021-2025 |
| CLO | 1599064 | 1005587 | 1134723 | 1258178 |
| ELO | 103157.1 | 42576.74 | 49995.78 | 54700.98 |
| NELO | 282498.7 | 223583.1 | 242835.2 | 267531.4 |

| | | | | |
|---|---|---|---|---|
| NWLO | 1751324 | 1156575 | 1277864 | 1413547 |
| SLO | 536138.9 | 354880 | 398046.3 | 444010.6 |
| SWLO | 980998.7 | 649340.7 | 728324.1 | 812427.2 |

## Summary and Concluding Remarks

Forecasts for rates of land development in commercial/ residential uses as well as rural residential uses (acreages from 1 through 25 acres) have bee made. In addition, prices have been estimate for these uses and future prices have been forecast. These are the essential parts of the plan and analysis. Based on these forecasts and various EIS alternatives developed by the DNRC staff, various measures of economic performance and impacts have been estimated. These clearly show that increases in development will add in generating income for current and future school children. Based on the economic analyses presented above, Alternative C is preferred to Alternative B and B is preferred to Alternative A.

## Literature Cited


Adair, Ann L. and Cheryl Heath. 2002. The Economic Impact of Home Construction on Montana Counties. Center for Applied Economic Research. Montana State University-Billings.

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